US GeoData
Digital Elevation Models

Digital Elevation Models

Digital elevation model (DEM) data consist of an array of regularly spaced elevations. The U.S. Geological Survey (USGS) DEM data are sold in 7.5-minute, 15-minute (Alaska only), and 1-degree units.

Data Production

The USGS has used four production methods to collect DEM data. Of these methods, only one, interpolation from vectors or digital line graph (DLG) hypsographic and hydrographic data, is currently used for 7.5-minute DEM's and other series DEM's. The following three methods (now discontinued or deactivated) were also used primarily for the production of 7.5-minute DEM data: (1) the Gestalt Photo Mapper II, an automated photogrammetric system designed to produce orthophotos, digital terrain data, and contours in subunits called patches; (2) manual profiling from photogrammetric stereomodels using stereoplotters equipped with three-axis electronic digital profile recording modules, by scanning stereomodels along successive terrain profiles; (3) interpolation of the elevations from stereomodel digitized contours, derived from stereoplotters equipped with three-axis digital recording modules used for compilation of 7.5-minute topographic quadrangle maps.

DEM data for 15-minute and 2-arc-second (30 minute) units are derived from DLG hy p s ographic and hy d ro - graphic data. DEM data for 1-degree units a re collected from topographic map sources, ranging from the 7.5-minute map series to the 1- by 2-degree map series, or from photographic sources by using image corre l ation systems.

Unit Size and File Extent

DEM data for 7.5-minute units corre-spond to the USGS 7.5-minute topo-graphic quadrangle map series for all of the United States and its territories except Alaska.
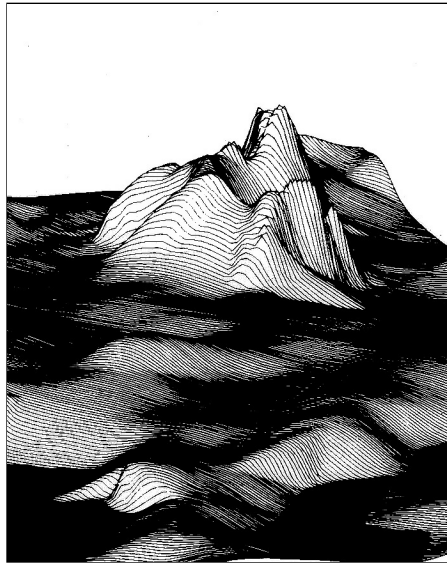
Portion of a 7.5-minute DEM plot of Tumwater,WA

Data for 2-arc-second (30 minute) DEM's provide coverage for the conterminous United States (except Alaska). This series is distributed as four units of 15-minute DEM data covering full 30- by 30-minute areas that correspond to the east or west half of the USGS 30- by 60-minute topographic quadrangle map series (1:100,000 scale).

DEM data for 15-minute units correspond to the USGS 15-minute topographic quadrangle map series in Alaska. The unit sizes in Alaska vary depending on the latitude. Units south of 59° N. cover 15- by 20-minute areas, those between 59° and 62° N. cover 15- by 22.5-minute areas, those between 62° and 68° N. cover 15- by 30-minute areas, and those north of 68° N. cover 15- by 36-minute areas. (All values are latitude-longitude, respectively.)

DEM data are produced by the National Imagery and Mapping Agency (NIMA) in l- by 1-degree units that correspond to the east or west half of USGS 1- by 2-degree topographic quadrangle map series (1:250,000 scale) for all of the United States and its territories. In Alaska these are west, central, and east files.

All nonstandard quadrangles with neat-lines that extend beyond the standard unit size to accommodate overedge bound-aries are collected and sold as multiples of the standard unit sizes.

Data Characteristics

All DEM data are similar in logical data structure and are ordered from south to north in profiles that are ordered from west to east. However, they differ in geographic reference systems and sampling intervals.

DEM data in 7.5-minute units consist of regular arrays of elevations collected on the North American Datum of 1927 (NAD27) or NAD83 (per users guide) horizontal datum. These data are stored as profiles with a Universal Transverse Mercator (UTM), 10- or 30-meter grid spacing, along and between each profile. The profiles do not always have the same number of elevations because of the variable angle between true north and grid north in the UTM system.

DEM data in 15-minute units consist of regular arrays of elevations collected on the NAD27 or NAD83 (per users guide) horizontal datum. The spacing betwe e n e l evations along pro files is 2 arc - s e co n d s of latitude by 3 arc-seconds of longi t u d e. E a ch pro file has 451 elevat i o n s .

DEM data in 1-degree units consist of a regular array of elevations collected on the Wo rld Geodetic System of 1972, h o ri zontal datum. A few units are also ava i l able using the Wo rld Geodetic System 1984 Datum. Spacing of the e l evations along and between each pro fi l e is 3 arc-seconds with 1,201 elevations per p ro fi l e. The only ex c eption is DEM dat a inAlaska, wh e re the spacing and nu m b e r of elevations per pro file va ry dep e n d i n g on the lat i t u d e. Latitudes between 50° and 70° N. have spacings at 6 arc - s e co n d s with 601 elevations per pro fi l e, and lat i - tudes gre ater than 70° N. have spacings at 9 arc-seconds with 401 elevations per profile.

Data Records

A DEM file is organized into three logical record types A, B, and C. The type A record contains information defining the general characteristics of the DEM, including its name, boundaries, units of measurement, minimum and maximum elevations, number of type B records, and projection parameters. There is only one type A record per DEM file. The type B record contains profiles of elevation data and associated header information. There is a type B record for each profile. The type C record contains statistics on the accuracy of the data.

Data Accuracy

The accuracy of DEM data depends on the source and resolution of the data samples. DEM data accuracy is derived by comparing linear interpolation elevations in the DEM with corresponding map location elevations and computing the statistical standard deviation or root-mean-square error (RMSE). The RMSE is used to describe the DEM accuracy. For 7.5-minute DEM's derived from photogrammetric source, 90 percent have a vertical accuracy of 7-meter RMSE or better and 10 percent are in the 8- to 15-meter range. For 7.5- and 15-minute DEM's derived from vector or DLG hypsographic and hydrographic source data, an RMSE of one-half contour interval or better is required. The 1-degree DEM data have an absolute accuracy of 130 meters horizontally and 30 meters vertically.

US GeoData Sampler

A US GeoData Sampler is available for a nominal charge. The sampler includes the 7.5-minute DEM and the 1:24,000-scale DLG for Tumwater, Washington; the 1:100,000-scale DLG for Tacoma, Washington; the 1:2,000,000-scale DLG for the Northwestern States (WA, OR, and ID); 1- by 2-degree land use and land cover data for Seattle, Washington; the 1-by 1-degree DEM for Seattle, Washington East; and the Geographic Names Information System data for the State of Washington.

Ordering Instructions

All DEM's are available on the following media: CD-Recordable, Internet "at cost" File Transfer Protocol (FTP) delivery *, 8-mm tape, 3,480-cartridge tape, and 9-track tape (6,250 bpi).

DEM data are written as ANSI-standard ASCII characters in fixed-block format on unlabeled or ANSI labeled 9-track magnetic tapes at a 6,250-bpi density. The logical record length is 1,024 bytes with a physical record size of 4,096 bytes or four logical records. DEM data may be ordered by specifying the unit size, maximum block size, and tape label, and by identifying the sales unit by topographic quadrangle name or by the southeast latitude and longitude corner coordinates.

* Except the 1- by 1-degree DEM's that are available at no charge using FTP from: <URL: http://edcwww.cr.usgs.gov/ doc/edchome/ndcdb/ndcdb.html>

The US GeoData Sampler can be ordered in standard or optional ASCII DLG formats, on either one 6,250-bpi or three 1,600-bpi tapes.

The Earth Science Information Center can furnish indexes, price lists, and order forms. Data users guides are included with each order.

For More Information

For information on these and other USGS products and services call 1-800-USA-MAPS, e-mail: esicmail@usgs.gov, or fax 703-648-5548.

The EARTHFAX fax-on-demand system is available 24 hours a day at 703-648-4888.

The address for the USGS home page is <URL: http://www.usgs.gov/>

The address for the WebGLIS is <URL: http://edcwww.cr.usgs.gov/ webglis>